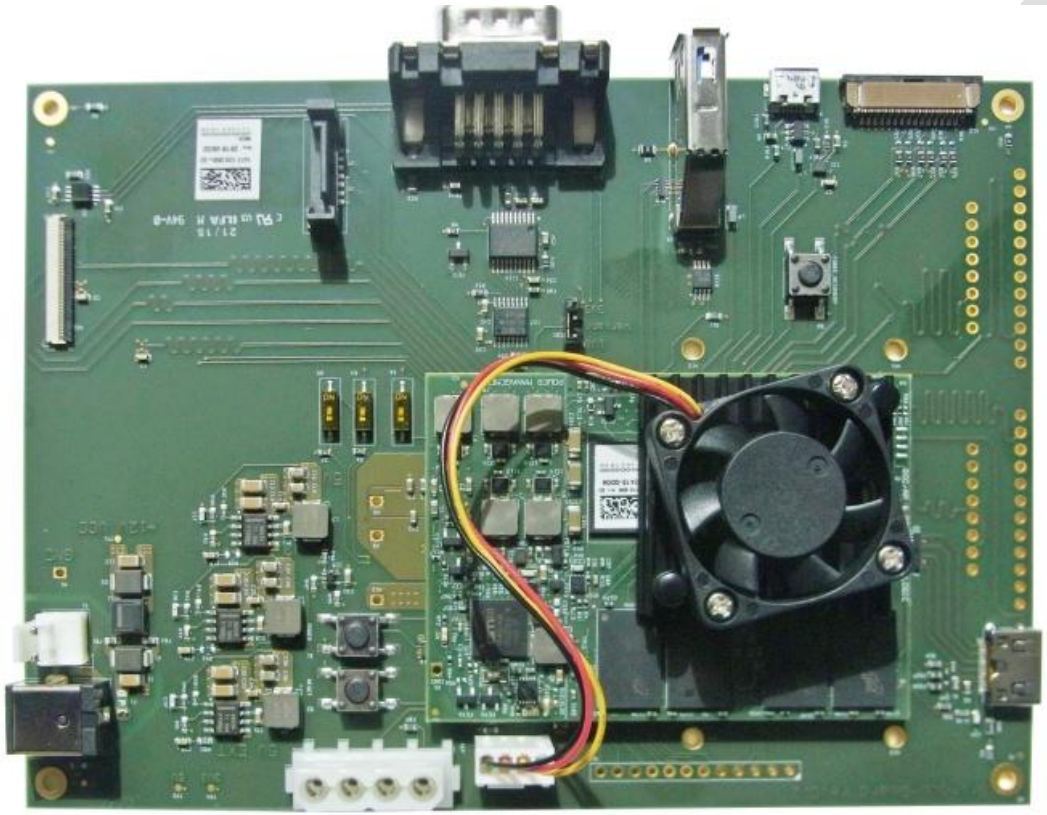

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User Guide

Meerkat K1 Bring-Up Kit

Product information

Avionic Design GmbH | Wragekamp 10 | 22397 Hamburg | Germany
Fon +49 -40 - 88 187-0 | info@avionic-design.de
www.avionic-design.de

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The Meerkat products are subject to change. Please check www.avionic-design.de for updates.

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Explanation of the symbols

•	Indicates a list of various items
▶	Indicates the result of a step
	Indicates additional information
	Indicates hyperlinked chapters and sections within the user guide

Abridged list of abbreviations

SOM	System on a Module, here: Meerkat K1 Processor Module
Bring-Up Kit	Meerkat K1 Bring-Up Kit
BUC	Meerkat K1 Bring-Up Carrier
TBD	To be defined

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1. Introduction

Meerkat - Let's innovate together!

Meerkat is a platform by Avionic Design that features NVIDIA's Tegra® technology. Meerkat defines the form factor, the pinout and the function set.

The Meerkat Bring-Up Kit consists of two core components: the Meerkat Tegra® K1 Processor Module (SOM) and the Meerkat Tegra K1 Bring-Up Carrier (BUC). The BUC is a bring up reference platform and you can use it as a basis for development. It carries the Meerkat Tegra K1 Processor Module, which features the NVIDIA® Tegra® K1 processor. The BUC will help you evaluate some of functions that the Meerkat K1 Processor Module has to offer.

User guide

This user guide will enable you to use the BUC. It will introduce all the relevant functions of the Meerkat Bring-Up Kit. and the required software for it.

This document will give you an overview of the BUC, its main components and the board connectors. It will show you how to start the BUC and how to use it properly in combination with the Meerkat K1 Processor Module.

This guide will show you how to use the pre-installed software or, if required, bootstrap the Bring-Up Kit.

Note
Please read all the information in this user guide carefully! For more information on the Meerkat K1 Processor Module, please read the **Meerkat K1 User Manual**. You can find it at ftp://ftp.avionic-design.de/pub/meerkat/ If you have any questions about this user guide, please contact Avionic Design.

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2. Technical properties

The lists below outline the main technical properties of the Meerkat K1 Bring-Up Carrier.

General	
Size	108 mm x 150 mm
Supply voltage	12 V nominal
CPU name	NVIDIA® Tegra® K1
Cooling	Heatsink with Fan

Options	
CSI	Connector not assembled*
DSI/CSI	Connector not assembled

Interfaces	Amount	Notes
SATA	1x	-
HDMI	1x	-
USB 3.0	1x	-
USB 2.0 client	1x	configurable as host
RS232	1x	-
DSI	1x	Display, 4 Lanes
various USER I/O	1x	-

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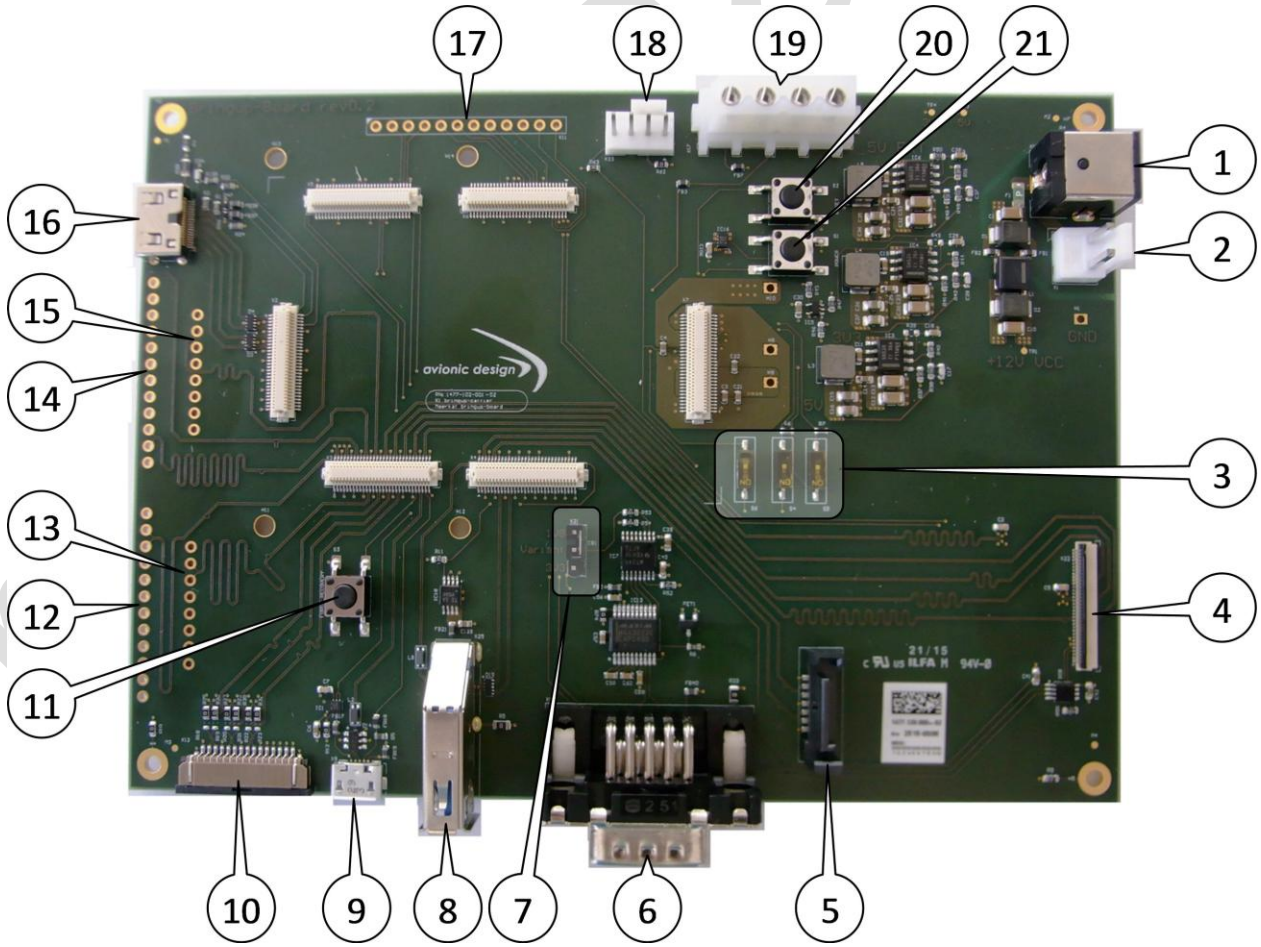
3. Overview of the Bring-Up Carrier

The following chapter will give you an overview of the Meerkat K1 Bring-Up Carrier and it will explain its main components.

3.1 Structure of the Bring-Up Carrier

Figure 1: Top view of the Bring-Up Carrier



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The explanation of **Figure 1**:

Number	Component	Connector
1	DC power jack (12 V)	X18
2	DC power connector (12V)	X1
3	Configuration pins	S4-S6
4	DSI A	X22
5	SATA	X16
6	Debug UART	X7
7	Configuration pin	X21
8	USB3	X25
9	Recovery / Bootstrap USB	X9
10	CSI Port	X12
11	Recovery button	S3
12	Connector 1 for CSI A	X20
13	Connector 2 for CSI A	X13
14	Connector 1 for CSI/DSI B	X8
15	Connector 1 for CSI/DSI B	X14
16	HDMI (Type C)	X19
17	General purpose pins	X11
18	Fan connector	X23
19	SATA power	X17
20	Reset button	S2
21	Power button	S1

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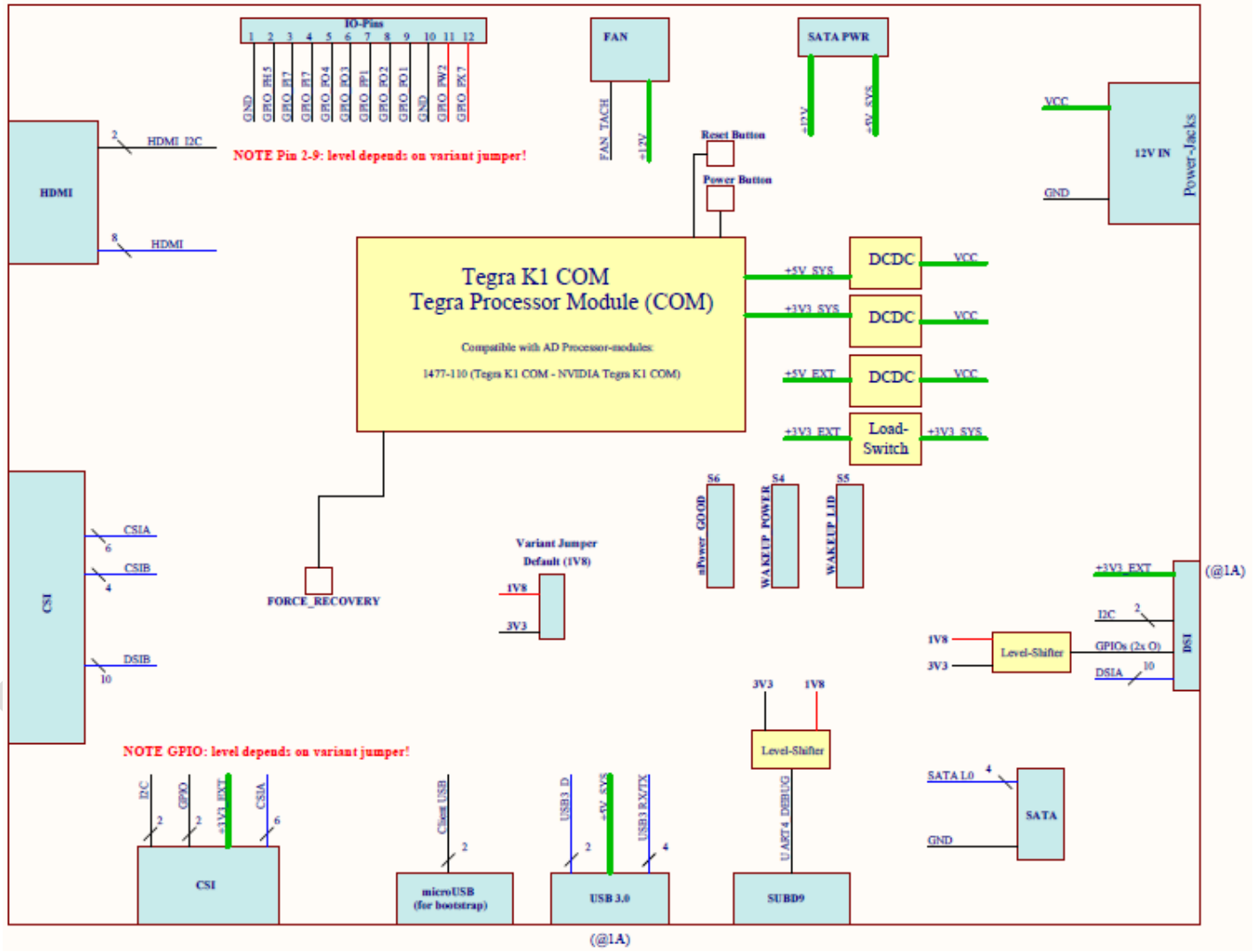
3.2 Function block diagram

In this chapter you will find an overview of the function block diagram for the Meerkat K1 Bring-Up Kit. You can find a larger version of this **Schematic** under the following Link: ftp://ftp.avionic-design.de/pub/meerkat/

Figure 2: Function block diagram for the Bring-Up Kit



3.3 Main components of the Bring-Up Kit

The Meerkat K1 Bring-Up Kit consists of the following main components:

- **Meerkat K1 Processor Module:**

  NVIDIA® Tegra™ K13 SoC (see **Meerkat K1 User Manual at:** ftp://ftp.avionic-design.de/pub/meerkat/)

- **Meerkat K1 Bring-Up Carrier:**

  The Meerkat K1 Processor Module needs to be plugged into the carrier on the
  Dual channel opto-isolator
  Motorola: MOCD217

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3.4 Pinouts of the connectors on the Bring-Up Carrier

In this chapter you will find a list of the pinouts of the connectors of the Meerkat K1 Bring-Up Carrier.

Connector	Component	Pinout
X1	DC power connector (JST - B2P-VH) (8 to 17V Input)	Pin 1: Power
		Pin 2: GND

Connector	Component	Pinout
X8	MIPI Port 1: DSI/CSI B 4 Lanes Connector I	Pin 1: GND
		Pin 2: DSI B D3 N
		Pin 3: DSI B D3 P
		Pin 4: GND
		Pin 5: GND
		Pin 6: DSI B CLK N
		Pin 7: DSI B CLK P
		Pin 8: GND
		Pin 9: GND
		Pin 10: DSI B D0 N
		Pin 11: DSI B D0 P
		Pin 12: GND

Connector	Component	Pinout
X14	MIPI Port 1: DSI/CSI B 4 Lanes Connector II	Pin 1: GND
		Pin 2: DSI B D2 N
		Pin 3: DSI B D2 P
		Pin 4: GND
		Pin 5: GND
		Pin 6: DSI B D1 N
		Pin 7: DSI B D1 P
		Pin 8: GND

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Connector	Component	Pinout
X2	Recovery / Bootstrap USB	Pin 1: VBUS
		Pin 2: D-
		Pin 3: D+
		Pin 4: ID
		Pin 5: GND

Connector	Component	Pinout
X23	DEBUG UART	Pin 1: not connected
		Pin 2: TX
		Pin 3: RX
		Pin 4: not connected
		Pin 5: GND
		Pin 6: not connected
		Pin 7: open
		Pin 8: open
		Pin 9: not connected

Connector	Component	Pinout
X11	General Purpose GPIOs Note: - Pin 1 to 10: Level depends on Jumper X21 (1,8V or 3,3V) - Pin 11 and 12	Pin 1: GND
		Pin 2: GPIO PH5
		Pin 3: GPIO PI7
		Pin 4: GPIO PK1
		Pin 5: GPIO PO4
		Pin 6: GPIO PO3
		Pin 7: GPIO PP1
		Pin 8: GPIO PO2
		Pin 9: GPIO PO1
		Pin 10: GND
		Pin 11: GPIO PW2
		Pin 12: GPIO PX7

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Connector	Component	Pinout
X12	CSI 2 Lanes Note: - Shared with X20. - Default X20	Pin 1: GND
		Pin 2: CSI A D0 Ext N
		Pin 3: CSI A D0 Ext N
		Pin 4: GND
		Pin 5: CSI A D1 Ext N
		Pin 6: CSI A D1 Ext N
		Pin 7: GND
		Pin 8: CSI A CLK Ext N
		Pin 9: CSI A CLK Ext N
		Pin 10: GND
		Pin 11: GPIO PH4
		Pin 12: GPIO PH2
		Pin 13: GEN I2C SCL
		Pin 14: GEN I2C SDA
		Pin 15: +3,3V Ext

Connector	Component	Pinout
X20	MIPI Port 0: CSI A 4 Lanes Connector I	Pin 1: GND
		Pin 2: CSI B D1 N
		Pin 3: CSI B D1 P
		Pin 4: GND
		Pin 5: GND
		Pin 6: CSI A CLK MIPI N
		Pin 7: CSI A CLK MIPI P
		Pin 8: GND
		Pin 9: GND
		Pin 10: CSI A D0 MIPI N
		Pin 11: CSI A D0 MIPI P
		Pin 12: GND

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Connector	Component	Pinout
X13	MIPI Port 0: CSI A 4 Lanes Connector II	Pin 1: GND
		Pin 2: CSI B D0 N
		Pin 3: CSI B D0 P
		Pin 4: GND
		Pin 5: GND
		Pin 6: CSI A D1 MIPI N
		Pin 7: CSI A D1 MIPI P
		Pin 8: GND

Connector	Component	Pinout
X16	Standard SATA	Pin 1: GND
		Pin 2: A+
		Pin 3: A-
		Pin 4: GND
		Pin 5: B-
		Pin 6: B+
		Pin 7: GND

Connector	Component	Pinout
X17	SATA power	Pin 1: Vcc (8-17V)
		Pin 2: GND
		Pin 3: GND
		Pin 4: +5 V

Connector	Component	Pinout
X18	Power Jack (8-17V Input)	Pin 1: Power
		Pin 2: GND

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Connector	Component	Pinout
X19	Standard HDMI (Type C)	Pin 1: TDMS D2 SHIELD
		Pin 2: TDMS D2+
		Pin 3: TDMS D2-
		Pin 4: TDMS D1 SHIELD
		Pin 5: TDMS D1+
		Pin 6: TDMS D1-
		Pin 7: TDMS D0 SHIELD
		Pin 8: TDMS D0+
		Pin 9: TDMS D0-
		Pin 10: CLK SHIELD
		Pin 11: CLK+
		Pin 12: CLK-
		Pin 13: DDC/CEC/HEC GND
		Pin 14: CEC
		Pin 15: I2C SCL
		Pin 16: I2C SDA
		Pin 17: HEC DATA-
		Pin 18: +5 V
		Pin 19: HEC DATA+

Connector	Component	Pinout
X21	Voltage Jumper	Pin 1: 1,8V
		Pin 2: Bank Power
		Pin 3: 3,3V

Preliminary

Connector	Component	Pinout
X22	DSI Display (DSI port A)	Pin 1: +3,3V
		Pin 2: +3,3V
		Pin 3: not connected
		Pin 4: LCD EN
		Pin 5: PWM
		Pin 6: I2C SDA
		Pin 7: I2C SCL
		Pin 8: not connected
		Pin 9: GND
		Pin 10: DSI A D2 P
		Pin 11: DSI A D2 N
		Pin 12: GND
		Pin 13: DSI A D1 P
		Pin 14: DSI A D1 N
		Pin 15: GND
		Pin 16: DSI A CLK P
		Pin 17: DSI A CLK N
		Pin 18: GND
		Pin 19: DSI A D0 P
		Pin 20: DSI A D0 N
		Pin 21: GND
		Pin 22: DSI A D3 P
		Pin 23: DSI A D3 N
		Pin 24: GND
		Pin 25: GND
		Pin 26: GND
		Pin 27: GND
		Pin 28: not connected
		Pin 29: not connected
		Pin 30: not connected
		Pin 31: +3.3 V
		Pin 32: +3.3 V
		Pin 33: +3.3 V
		Pin 34: +3.3 V

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Connector	Component	Pinout
X23	Fan	Pin 1: not connected
		Pin 2: FAN TACH
		Pin 3: +12V
		Pin 4: GND

Connector	Component	Pinout
X25	USB 3	Pin 1: VCC
		Pin 2: D-
		Pin 3: D+
		Pin 4: GND
		Pin 5: SSRX-
		Pin 6: SSRX+
		Pin 7: GND
		Pin 8: SSTX-
		Pin 9: SSTX+

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4. First steps

This chapter will show you how to start the Meerkat K1 Bring-Up Kit and enable you to work with it.

4.1 Unpack the Meerkat K1 Bring-Up Kit

The TEC-NG and its components are individually packaged to deliver them safely (see **Figure 3**).

Figure 3: Packaged TEC-NG and its components

Explanation:
1. Bring-Up Kit
2. Small parts
3. Info flyer

1. Carefully unpack each component.
2. Compare the delivered components with the list in **Chapter Fehler! Verweisquelle konnte nicht gefunden werden.**.

Please contact Avionic Design, if a component is missing.

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4.2 Turn on the Bring-Up Kit

This chapter describes how to connect all the peripherals with the Bring-Up Kit and how to turn on the Bring-Up Kit.

1. Before you turn on the Bring-Up Kit, connect all the peripherals with the Bring-Up Kit

   - USB Hub
   - 1x HDMI cable (Type A to Type C)
   - 1x RS232 null modem cable
   - 1x Ethernet cable

   Optional items:
   - 1x computer with a terminal emulator
   - USB Hub with Type A plug
   - 1x keyboard with a USB Type A plug
   - 1x mouse with a USB Type A plug
   - 1x USB 3 to Ethernet Adapter (e.g. Edimax EU-4208)
   - 1x HD monitor with HDMI port (Type A)

   or alternatively to an HD monitor:

2.1 Put the USB Hub into the USB ports of the Bring Up Kit (see **Figure 4**).
2.2 Put the USB plugs of the mouse, keyboard and USB-Ethernet Adapter into the USB Hub.
2.3 Put one plug of the Ethernet cable into your local Ethernet network (with a DHCP server already set-up) and put the other plug into the USB-Ethernet Adapterport of the Bring-Up Kit.

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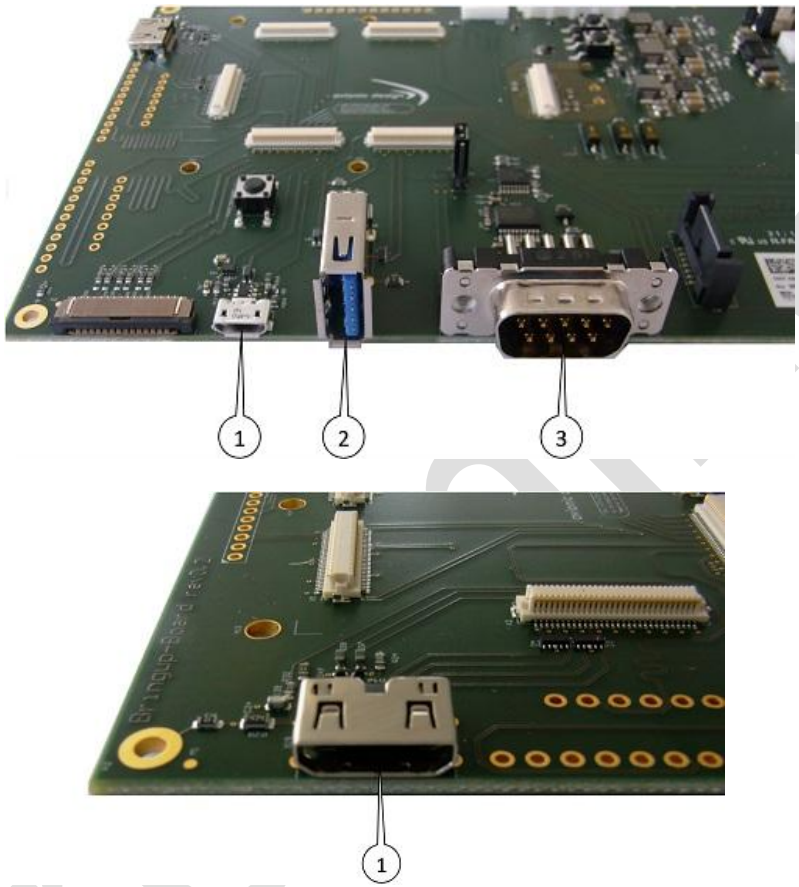
Figure 4: Get access to the Bring Up Kit through these ports



Explanation:
1. USB Recovery
2. USB port
3. Debug UART port
4. HDMI port

2.4 Put one plug of the HDMI cable into an HD monitor and put the other plug into the HDMI port of the Bring-Up Kit (see **Figure 4**). Alternatively you can connect the Bring-Up Kit to a DSI display.

2.5 Put one plug of the RS232 null modem cable into the serial port of the computer and put the other plug into the Debug Serial/RS232 port of the Bring-Up Kit (see **Figure 4**).

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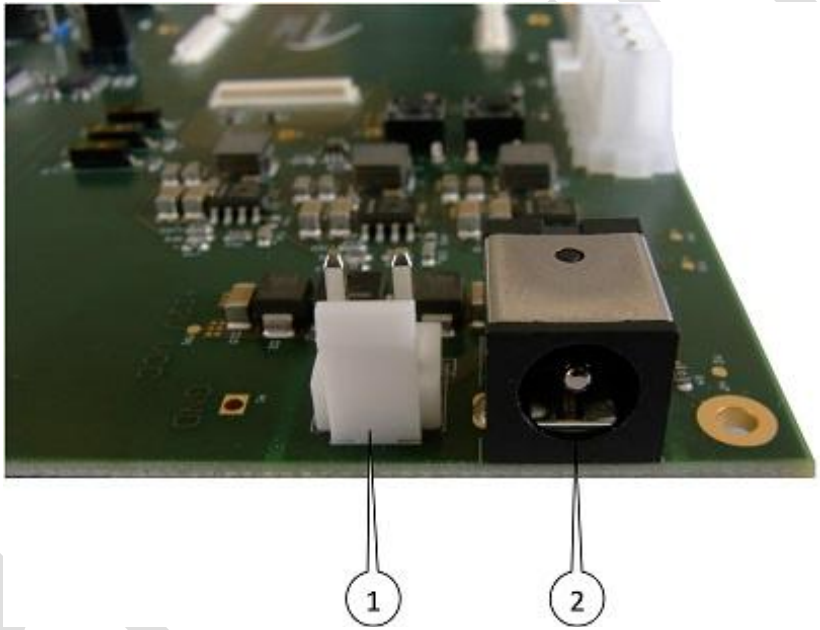
3. After you connected the peripherals with the Bring-Up Kit, prepare these provided items to turn on the Bring Up Kit:
   - 1x 12 V power supply (DC power supply (12V, 3 A). Jack Type PJ-063AH. (Inner contact +)

3.1 Put the plug of the 12 V power supply into a power outlet and put the power connector into the DC power jack of the Bring Up Kit (see **Figure 5**): ⊖—●—⊕

3.2 If your power outlet does not match the plug of the power supply, attach a plug adapter to the plug.

▶ The Bring-Up Kit has a power supply but the Bring-Up Kit is not turned on. The fan is running.

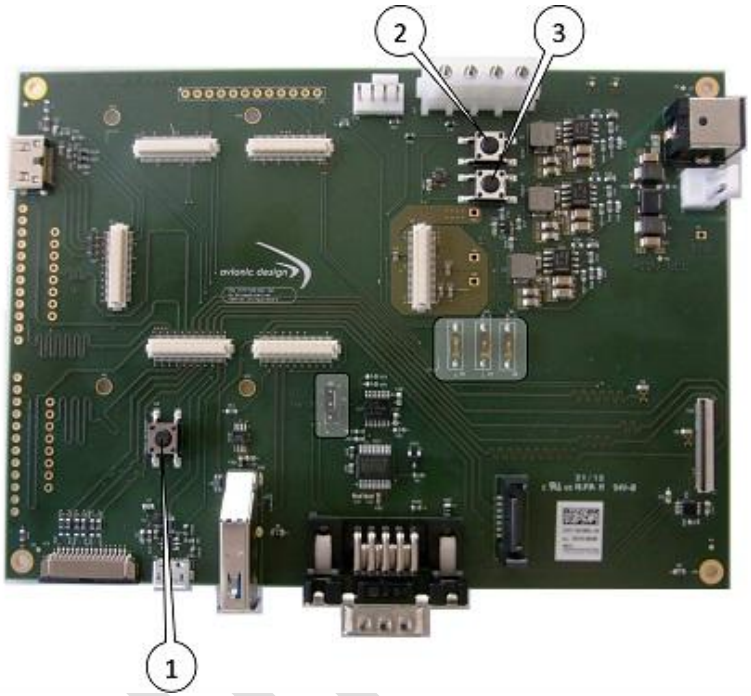
Figure 5: Turn on the TEC with these components



Explanation:
1. DC power connector
2. DC power jack

Preliminary

Figure 6: Turn on the Bring-Up Kit with these components



Explanation:
1. Recovery button
2. Reset button
3. Power button

4. Push the power / reset button (see **Figure 5**) for approx. 1 second.
   ▶ The TEC-NG is on.

Caution
The NVIDIA® Tegra™ K1 SoC as well as other components are running hot, when the Meerkat products are turned on. To prevent burns, please do not touch the NIVIDA® Tegra™ K SoC and other components.

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When the Bring-Up Kit is on, you can get access to the Bring-Up Kit in two different ways:

- You can get access to the shell of the Bring-Up Kit through the Debug Serial/RS232 port (see **Chapter 4.3.1**)
- You can get remote access to the shell of the Bring-Up Kit through SSH/ the Ethernet port (see **Chapter 4.3.2**)

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4.3 Get access to the shell of the Bring-Up Kit

After you turned the Bring-Up Kit on, you can get access to the shell of the Bring-Up Kit through either:

- the Debug Serial/RS232 port (see **Chapter 4.3.1**)

or

- SSH/Ethernet (see **Chapter 4.3.2)**

4.3.1 Get access through the Debug Serial/RS232 port

1. Make sure that you connected the Bring-Up Kit and a computer with the provided RS232 cable and that the Bring-Up Kit is turned on (see **Chapter 4.2**).

2. Open the terminal emulator on the computer.

Note
Examples for terminal emulators are Minicom™ for Linux OS or Tera Term™ for Windows OS.

3. Set up your terminal emulator with the following parameters:
   - Baud rate: 115200
   - Data length: 8
   - Parity: none
   - Stop bit: 1
   - Flow control: none

▶ When you press the power button (see **Figure 5**), the boot-up process will start.
▶ You should see various kernel messages during the boot-up process.
▶ When the boot-up process is complete, you will see a login prompt.

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4. Log in with the following parameters:
   - Username: root
   - Password: password

▶ The Linux shell opens after the login.
▶ A hashtag (#) prefixes each line and shows that you have root permissions.

Note
Be careful, when you have root access! You can permanently damage the system and make it inoperable!

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4.3.2 Get access through SSH/Ethernet

The Bring-Up Kit has no Ethernet interface. Ethernet can be used with an USB to Ethernet Adapter (e.g. Edimax EU-4208).

1. Make sure that you connected the Bring-Up Kit with the adapter to your local Ethernet network with an Ethernet cable (see **Chapter 4.2)**.

2. To connect to the Bring-Up Kit via SSH, you need to determine the IP address of the system.

2.1 Read the instructions in **Chapter 4.3.1** to get access to the Linux shell of the TEC-NG.

2.2 Write the command `ifconfig` into the Linux shell
▶ You will receive the IP address of the Bring-Up Kit.

Note
The actual IP address depends on the settings of the DHCP server.

2.3 To connect to the Bring-Up Kit via SSH using the IP address, write the command:

```
$ ssh root@<ip address>
```

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5. Boot concept

This chapter will outline the boot concept of the Meerkat K1 Processor Module.

The eMMC of the Meerkat K1 Processor Module contains a pre-installed GNU/Linux operating system.

5.1 Boot loader

The eMMC is preflashed with a boot-loader called U-Boot™. It is a universal boot-loader and it supports various computer architectures. It loads the kernel.

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5.2 Bootstrap the system

The bootstrapping process puts the system into a defined bootable condition. The pre-installed operating system on the SOM is GNU/Linux system based on buildroot. You can bootstrap the SOM and rebuild your own system based on Linux.

This invoves two steps:

1. Building and flashing the bootloader.
2. Building and flashing the kernel and root filesystem.

5.2.1 Activate recovery mode

Before you activate the recovery mode of the Bring-Up Kit, make sure you have all the necessary items:

Your delivery includes this item:

- 1x USB Mini-B to USB Type A cable

Your delivery does not include this necessary item:

- 1x computer with a Linux OS

1. Put the USB Mini-B plug into the recovery USB port (see **Figure 1**) and put the USB Type A plug into a USB port on your computer.

2. The Module must be powered on

3. Push and hold the recovery button (see **Figure 5**)

4. Push the reset button to reset on the BUK.

5. Release the recovery button.
   ▶ The recovery mode is activated.

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5.2.2 Flash the bootloader

Here for you need to be in recovery mode.The procedure to Flash Uboot onto the target is described in the “software” section of the Meerkat User Manual which can be found under the following link

ftp://ftp.avionic-design.de/pub/meerkat/

5.2.3 Rebuilding and customization the kernel and root filesystem

The source code for the preflashed operation system is published on git hub. It can be found under the following link:

https://github.com/avionic-design/buildroot-external-ad/

There can be found a README which includes detailed instructions how to build the kernel and root file system and erlaubt die customization like adding and removing software packages.

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Contact

If you have any questions about the Meerkat K1 Bring-Up Kit, you can contact us at:

Avionic Design GmbH

Wragekamp 10

22397 Hamburg

Germany

www.avionic-design.com

info@avionic-design.com

Fon: +49 - 40 - 88 187 0

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